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is of the O-400 type and was put into production in April. Without its cargo of bombs, the machine weighs 9,000 pounds and to drive it requires fuel consumption of approximately sixty gallons an hour. The Liberty motors are in an armored compartment on either side of the fuselage. In addition to its bombs, the machine also mounts two light Browning machine guns, which can be fired from any desired angle.

Samuel Pierpont Langley, secretary of the Smithsonian Institution, died on February 27, 1906, at the beginning of the era of mechanical flight to which his researches had so largely contributed. In 1905 the Wright Brothers remained in the air for half an hour but it was not until 1908 that they fully demonstrated the practicability of sustained flight. Langley began his experiments when he was director of the Allegheny Observatory, and in 1887 carried on experiments with free flight models. He showed as the result of experiment and theory that one-horse power would propel and sustain in horizontal flight at the velocity of about forty miles an hour somewhat more than two hundred pounds. In 1901 Langley began the construction of a light steam-engine as a motor. Daimler had invented the internal combustion engine in 1885, but it was necessary to await for the development of the automobile to demonstrate the remarkable combination of power and lightness in an engine which has made possible the contemporary aeroplane. Mr. Langley was, however, able to construct an aerodrome, as he called it, which weighed about 44 pounds and which flew for half a mile on May 6, 1896. In 1898 the War Department appropriated \$50,000 for experiments with a man-carrying aerodrome. After many experiments and after overcoming many difficulties, the attempt was made to launch the aero-

drome, with Mr. Manley as aviator, on October 7, 1903. Owing to defects in the launching the trial ended disastrously, and Mr. Manley narrowly escaped drowning. The experiment was repeated on December 8, when again the launching gear was at fault, and the aerodrome had no opportunity to demonstrate its power of flight. Owing mainly to ridicule in the newspapers and the fear of its effect on the Congress, the Army Board was unwilling to continue the work. The Langley aerodrome, however, with a new engine flew over Lake Kenka in June, 1918.

ANCIENT ARMOR ADOPTED TO MODERN WARFARE¹

THE war has brought back into use many discarded weapons and practices of medieval warfare. This is shown in the adoption of steel helmets by all the warring powers; in the use of heavy breastplates by the Germans, and lighter breastplates, for attack, by the English; in the armored waistcoats used by the Italians and in trench shields which all the armies are using. Because of this it has become desirable to review the entire study of ancient armor, to which for centuries some of the greatest artists and scientists gave their best efforts. To such masters of the science of armor design as Leonardo, Guilio Romano, Cellini, Holbein, Duerer, Michael Angelo, and others, are ordnance experts of today turning for guidance and inspiration. In fact, it can be stated that so completely were armored defenses studied in the past that today there is scarcely a technical idea brought forward which was not worked out in elaborate detail by the old-time armor makers.

Fortunately for the Ordnance Department, one of the greatest collec-

¹ Publication authorized by the War Department.

tions of ancient armor in the world, accessible to study by the American armor designers, is in the Metropolitan Museum of Art in New York City. This collection, ranking probably seventh in the world, now includes the famous Riggs Collection, which represents the life work of a wealthy student of the subject, and includes some of the richest and rarest pieces that have been in the market since 1850. It is as an incident to this collection that there was established at the museum an armorer's workshop. So far as is known it is unique. It was established for the purpose of cleaning, repairing, or, in rare cases, restoring pieces that were defective. To this end the museum has studied exhaustively the processes of making armor, and has collected from all parts of the world the tools of the ancient armorer's art.

When the war broke out, learning that the government was in need of skilled makers of models for the preparation of armor, Director Robinson, of the Metropolitan Museum, with the sanction of the trustees, placed the department of armor at the disposition of Secretary of War Baker. Since then numerous designs have been carefully worked out by Major Dean and actually made by Tachaux and his young French assistant, Sergt. Bartel, now of the Ordnance Department.

Major Dean, himself, was brought into the service of the Army in November, 1917. Owing to his lifelong study of the subject he was commissioned as a major and sent abroad at once to report on the status of armor. He returned to the United States late in January and has kept the armor workshop of the museum busy, week days and holidays, turning out models in accordance with the suggestions of General Pershing and the Ordnance Department. No less than 25 different types of armor defenses have been made in various factories in

experimental lots, including in number from a few score to many thousand pieces, some of which have found favorable comment at American headquarters. These armor defenses include even arm and leg guards, the use of which was suggested by the study of hospital statistics in France and England. It appeared that more than 40 per cent. of the hospital casualties suffered were leg wounds, and no less than 33 per cent. arm wounds.

In connection with this work every effort has been made to improve the character of metal used in the armor making. A committee of the National Council of Defense, including the names of such armor experts as Alexander McMillan Welch, Edward Hubbard Litchfield, Ambrose Monnell, Dr. G. O. Brewster, and Clarence H. Mackay, has dealt especially with the problem of personal armor. And some of the most eminent metallurgists of the country, including those on the committee, have devoted almost their entire time to the question. Among these is Professor Henry M. Howe, of Columbia University, who has made an exhaustive study of helmet metal, aiming to give the American soldier better protection than the soldier of any other nation.

SCIENTIFIC ITEMS

WE record with regret the death of Richard Rathbun, assistant secretary of the Smithsonian Institution, in charge of the National Museum; of Henry Shaler Williams, emeritus professor of geology at Cornell University; of John Duer Irving, professor of economic geology at Yale University, while engaged in war work in France; of Henry George Plimmer, professor of comparative pathology in the Imperial College of Science and Technology, and of Ludwig Edinger, director of the Neurologic Institute of Frankfort-on-Main.